U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the

CAPITAL AREA GROUND WATER CONSERVATION COMMISSION

WATER-RESOURCES INVESTIGATIONS REPORT 03-4020
Water Withdrawals--SHEET 1 OF 2
Griffith, J.M., Lovelace, J.K., 2003, Louisiana ground-water map no. 15: Potentiometric surface of the "1,200-foot" sand of the Baton Rouge area, Louisiana, spring 2001

INTRODUCTION

The "1,200-foot" sand of the Baton Rouge area is a major source of fresh ground water in a five-parish area which includes East and West Baton Rouge, East and West Feliciana, and Pointe Coupee Parishes (hereinafter referred to as the Baton Rouge area) in southeastern Louisiana (fig. 1). In 2001, the "1,200-foot" sand was the fourth most heavily pumped aquifer of the 14 aquifers (fig. 2) underlying this area. In 2001, about 20.8 Mgal/d were withdrawn from the "1,200-foot" sand in the Baton Rouge area (fig. 3). Of this amount, about 55 percent was used for public supply, about 6 percent for power generation, and about 38 percent for industrial purposes (D.C. Dial, Capital Area Ground Water Conservation Commission, written commun., 2002). Most of the water, about 18.5 Mgal/d, was withdrawn in East Baton Rouge Parish (D.C. Dial, Capital Area Ground Water Conservation Commission, written commun., 2002). From 1990 to 2001, withdrawals from the "1,200-foot" sand increased by about 26 percent (from 16.6 to 20.8 Mgal/d, fig. 3) in the Baton Rouge area.

Pumpage from the "1,200-foot" sand has caused water-level declines in the Baton Rouge area (Meyer and Turcan, 1955, p. 54, 57). Also, previous studies have indicated the possibility that saltwater[1] encroachment (horizontal movement) into freshwater areas has occurred (Tomaszewski, 1996, p. 6; Whiteman, 1979, p. 41-42).

Additional knowledge about ground-water flow and effects of withdrawals on the "1,200-foot" sand of the Baton Rouge area is needed to assess ground-water-development potential and to protect the resource. To meet this need, the U.S. Geological Survey (USGS), in cooperation with the Capital Area Ground Water Conservation Commission (CAGWCC), began a study in 2000 to measure and document the current (2001) water levels in wells screened in the "1,200-foot" sand, construct a potentiometric-surface (water-levels) map, and to evaluate changes in the potentiometric surface.

This report presents data and maps that describe the potentiometric surface of the "1,200-foot" sand of the Baton Rouge area during the spring of 2001. Graphs of water levels in selected wells and water withdrawals from the "1,200-foot" sand are presented to show the historical changes in water levels and water use. The potentiometric-surface map illustrates the water levels and ground-water flow directions in the aquifer for spring 2001. Water-level and water-use data are on file at the USGS and CAGWCC offices in Baton Rouge, Louisiana.

Description of Study Area

The study area (fig. 1) extends across about 2,000 mi^2 and includes East and West Baton Rouge, East and West Feliciana, and Pointe Coupee Parishes (Calhoun and Frois, 1997, p.153). The City of Baton Rouge and several industrial facilities are located in the study area along the Mississippi River. The climate is generally warm and temperate with high humidity and frequent rain. At Baton Rouge, the average annual temperature is 68°F, and the average annual rainfall is about 60 in. (National Oceanic and Atmospheric Administration, 1995, p. 5, 8). With the exception of the Baton Rouge metropolitan area, much of the study area is rural and agricultural.

Hydrogeologic Setting

Beneath the study area is a sequence of complexly interbedded, interconnected, lenticular, alluvial, freshwater-bearing, sandy, and graveliferous strata that form a wedge of sediment that dips and thickens in a south-to-southwest direction. Fourteen freshwater aquifers (fig. 2) in the area are composed of sediment that can contain very fine to coarse sand and pea- to cobble-size gravel (Meyer and Turcan, 1955, p. 13-47). Thirteen of the aquifers were originally named according to their general depth in the Baton Rouge industrial district (Meyer and Turcan, 1955, p. 13). A prominent hydrogeologic feature in the region is the Baton Rouge fault (fig. 1) which extends from east of the study area, through East and West Baton Rouge Parishes, to west of the study area (Durham and Peeples, 1956; Murray, 1961, p. 188-190; McCulloh, 1991, p. 1-20).

Precipitation in the northern part of the study area and north of the study area in Mississippi is the primary source of recharge of freshwater to the "1,200-foot" sand. Because the aquifers in the region are interconnected, some infiltrated precipitation percolates down into and through the surficial aquifers in the recharge area to deeper interconnected aquifers, which include the "1,200-foot" sand (Morgan, 1963, p. 11-13). Generally, water continues to move downdip in a southerly direction through the aquifer toward the Baton Rouge fault at rates that range from a few tens of feet per year to several hundreds of feet per year (Buono, 1983, p. 24). The southern limit of freshwater in the "1,200-foot" sand generally is considered to be at or near the Baton Rouge fault (Tomaszewski, 1996, p. 6).

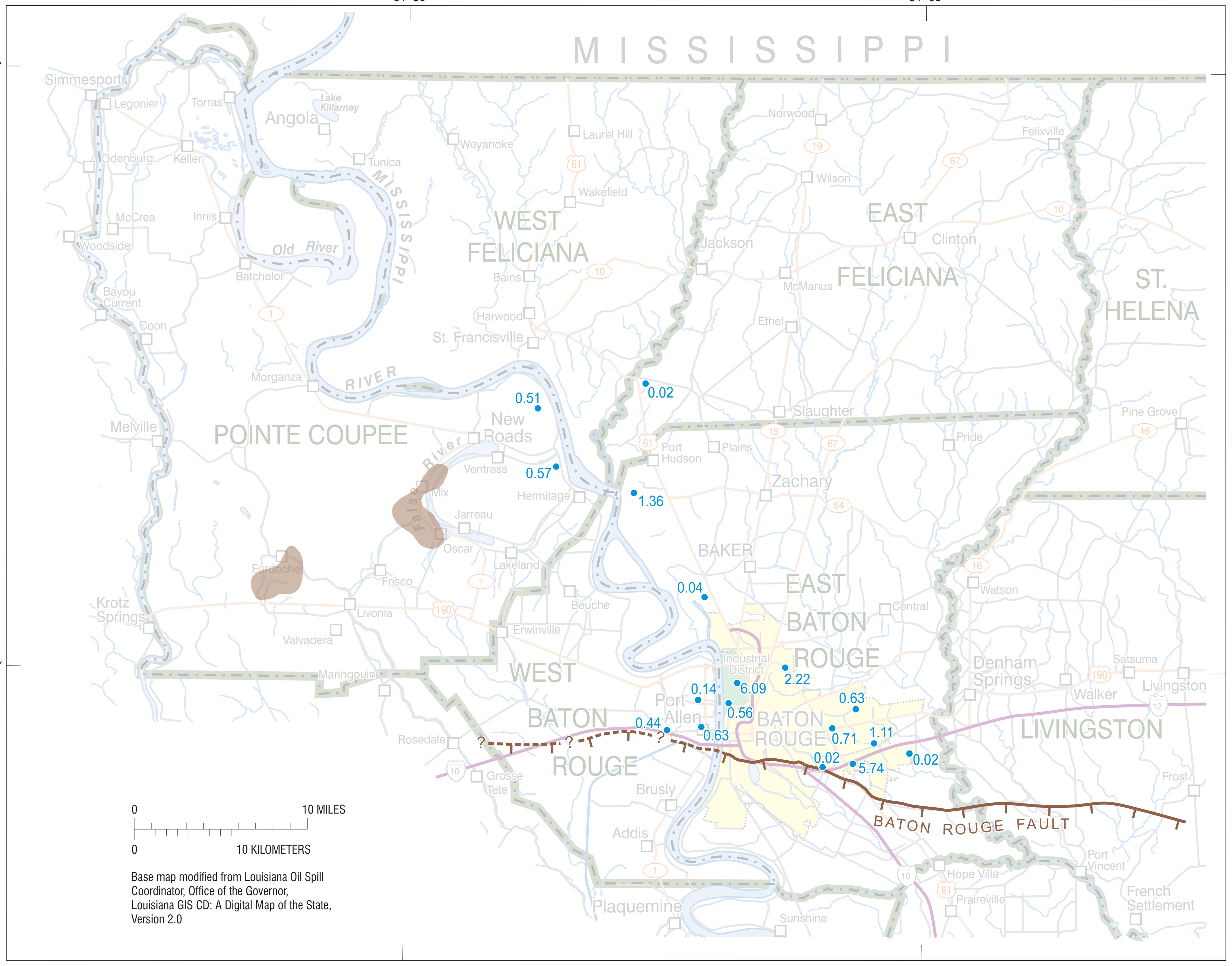
Development of the "1,200-foot" sand increased substantially after 1953 (Morgan, 1961, p. 36; Kazmann, 1970, fig. 9). From 1943 to 2001, water levels declined about 140 ft at well WBR-5 (fig. 3). Well WBR-5 is located near pumping centers in the Baton Rouge industrial district (fig. 4). However, from 1961 to 2001, water levels at well EF-6 changed less than 25 ft (fig. 3). Although both wells are screened in the "1,200-foot" sand, well EF-61 is located near the recharge area and where little or no water withdrawals occur.

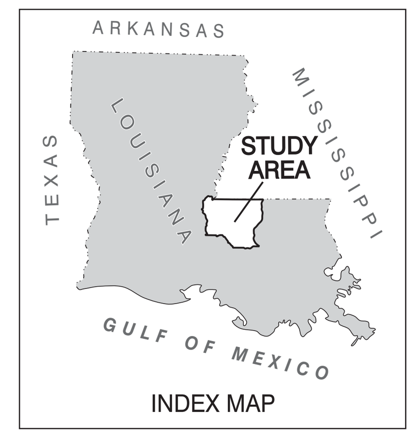
Before development, water entered the "1,200-foot" sand in the recharge area, and flowed generally in a south to southwest direction to the discharge area near the Baton Rouge fault (Meyer and Turcan, 1955, p. 51; Morgan, 1963, p.13). At the discharge area, the Baton Rouge fault can act as a leaky barrier to horizontal ground-water flow (Whiteman, 1979, p. 12, 13). Also, water from the recharge area would move upward (probably along the fault) from the "1,500-foot" sand into the "1,200-foot" sand and from the "1,200-foot" sand into the "1,000-foot" sand due to vertical head[2] differences at the discharge area (Meyer and Turcan, 1955, p. 51; Morgan, 1963, p. 13). Recently, however, water withdrawals in the study area have caused water to flow toward pumping centers and reduced the vertical head gradient in what was the discharge area near the fault, and the upward movement of water has diminished (Meyer and Turcan, 1955, p. 51; Morgan, 1963, p. 13).

Large water withdrawals north of the fault might have induced saltwater encroachment from south of the fault toward pumping centers north of the fault where the "1,200-foot" sand previously contained freshwater (Tomaszewski, 1996, p. 36). Chloride concentrations above background levels (10 mg/L) were detected in water from well EB-621 (figs. 4, 5) from 1978 to 1988 and in 1992 (Tomaszewski and Anderson, 1995, table 6). Tomaszewski (1996, fig. 20) shows a 0.5-mi^2 area of saltwater at well EB-621 in the vicinity of Jefferson Highway at Interstate 12 in Baton Rouge. Tomaszewski (1996, p. 36) states that the increased chloride concentration might be due to upconing of saltwater from the base of the aquifer during pumping or leakage of saltwater across the fault.

[1]Saltwater in this report is defined as water that contains chloride at concentrations of more than 250 mg/L. Concentrations of chloride greater than 250 mg/L exceed the Secondary Maximum Contaminant Level (SMCL) for drinking water (U.S. Environmental Protection Agency, 1977, 1992). SMCL's are established for contaminants that can adversely affect the aesthetic quality of drinking water. In high concentrations or values, health implications as well as aesthetic degradation may also exist. SMCL's are not federally enforceable, but are intended as guidelines for the states.

[2]The altitude to which water rises (in a well) at a given point as a result of reservoir pressure (Bates and Jackson, 1984, p. 231).





EXPLANATION

APPROXIMATE AREA WHERE THE AQUIFER IS THIN OR ABSENT (Winner and others, 1968, pl. 5)

FAULT -- Dashed and queried where probable. Hachures on downthrown side (modified from McCulloh, 1991, pl. Ia-e)

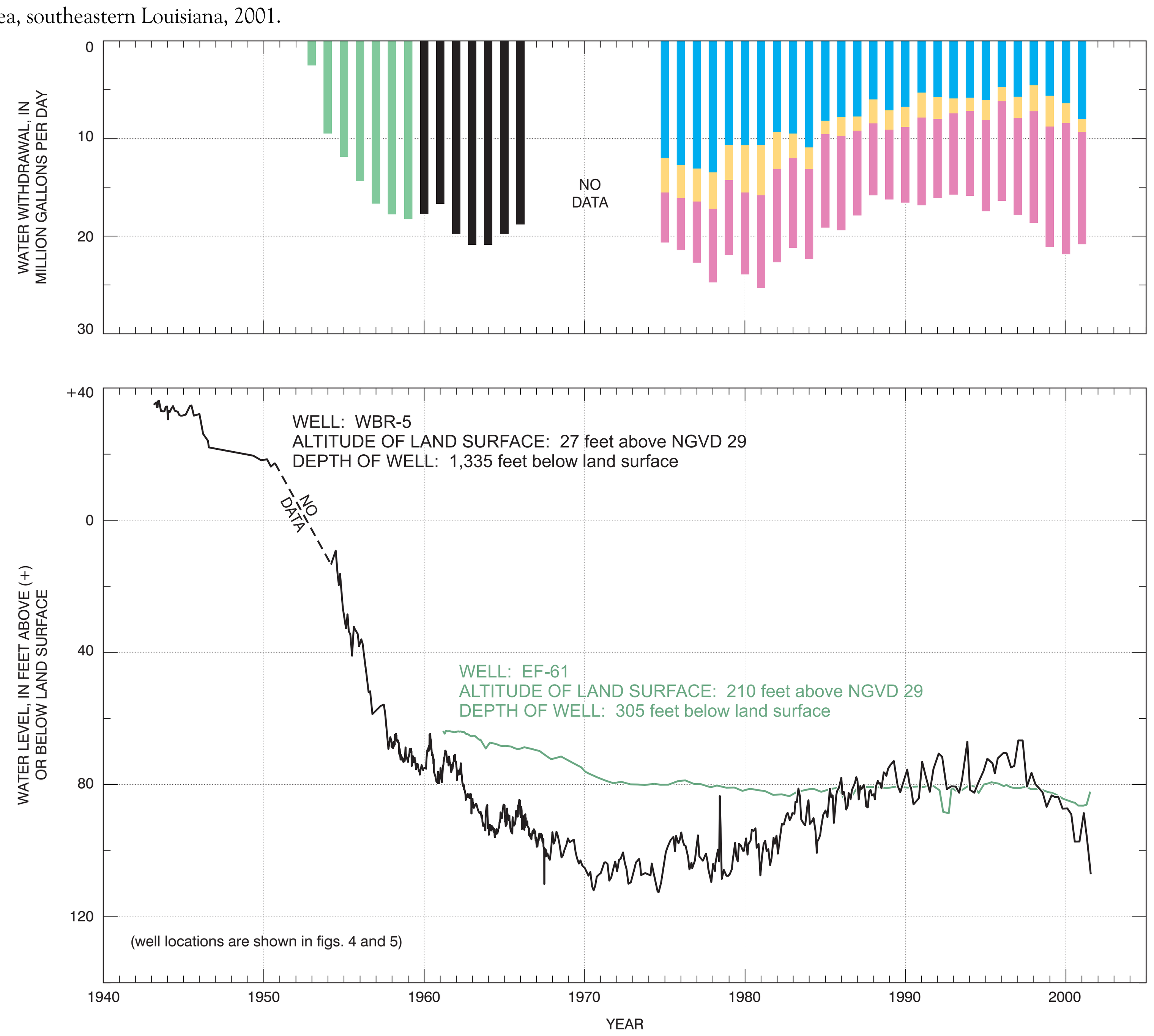
0.63 WATER-WITHDRAWAL SITES -- Shows withdrawals, in million gallons per day. Some sites include multiple wells (D.C. Dial, Capital Area Ground Water Conservation Commission, written commun., 2002)

Figure 1. Water withdrawals from the "1,200-foot" sand and location of the study area in the Baton Rouge area, southeastern Louisiana, 2001.

System	Series	Stratigraphic unit		Aquifer[1] or confining unit
Quaternary	Holocene	Mississippi River and other alluvial deposits		Mississippi River alluvial aquifer
	?			
	Pleistocene	Unnamed Pleistocene deposits		Shallow sands
				Upland terrace aquifer: "400-foot" sand
				Upland terrace aquifer: "600-foot" sand
Tertiary	Pliocene	Fleming Formation	Blounts Creek Member	"800-foot" sand
				"1,000-foot" sand
				"1,200-foot" sand
	?			"1,500-foot" sand
	Miocene			"1,700-foot" sand
			Castor Creek Member	Unnamed confining unit
			Williamson Creek Member	"2,000-foot" sand
			Dough Hills Member	"2,400-foot" sand
			Carnahan Bayou Member	"2,800-foot" sand
			Lena Member	Unnamed confining unit
	? Oligocene	Catahoula Formation		Catahoula aquifer

[1]Clay units separating aquifers in the Baton Rouge area are discontinuous and unnamed.

Figure 2. Hydrogeologic units in the Baton Rouge area, southeastern Louisiana (modified from Stuart and others, 1994, fig. 5; Lovelace and Lovelace, 1995, fig. 1).



EXPLANATION

WITHDRAWALS 1953 to 1959 -- Shows total withdrawals from the "1,200-foot" sand (modified from Morgan, 1961, fig. 18 and p. 36)

WITHDRAWALS 1960 to 1966 – Shows total withdrawals from the "1,200-foot" sand (modified from Kazmann, 1970, fig. 9)

WITHDRAWALS 1975 to 2001 – Shows withdrawals by category from the "1,200-foot" sand (D.C. Dial, Capital Area Ground Water Conservation Commission, written commun., 2002). Withdrawals for irrigation were recorded for 1986 to 1997 and 1999 but accounted for less than one percent of the total withdrawals each year, and therefore are not shown here

- INDUSTRY
- POWER GENERATION
- PUBLIC SUPPLY

Figure 3. Water withdrawals from the "1,200-foot" sand and water levels in wells WBR-5 and EF-61 in the Baton Rouge area, southeastern Louisiana.

CONVERSION FACTORS, DATUMS, AND ABBREVIATED WATER-QUALITY UNIT

Multiply	By	To obtain
inch (in.)	25.4	millimeter (mm)
foot (ft)	0.3048	meter (m)
foot per year (ft/yr)	0.3048	meter per year (m/yr)
mile (mi)	1.609	kilometer (km)
square mile (mi^2)	2.590	square kilometer (km^2)
million gallons per day (Mgal/d)	3,785	cubic meter per day (m^3/d)

Temperature in degrees Fahrenheit (°F) can be converted to degrees Celsius (°C) as follows: °C = (°F - 32)/1.8.

Vertical coordinate information in this report is referenced to the National Geodetic Vertical Datum of 1929 (NGVD 29)--a geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called Sea Level Datum of 1929.

Horizontal coordinate information in this report is referenced to the North American Datum of 1927.

Abbreviated water-quality unit:
milligrams per liter (mg/L)

Louisiana Ground-Water Map No. 15:

Potentiometric Surface of the "1,200-Foot" Sand of the Baton Rouge Area, Louisiana, Spring 2001

By

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2003

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Acknowledgments

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POTENTIOMETRIC SURFACE

Potentiometric-surface maps (figs. 4, 5) were constructed using water-level data from 25 wells completed in the "1,200-foot" sand (table 1). Water levels were measured during April and May 2001. Water levels were measured using steel or electrical tapes marked with 0.01-ft gradations. Wells in which water levels were measured were not being pumped at the time the measurements were made. If wells recently were pumped, water levels were measured after an appropriate recovery period. Water levels were not measured south of the Baton Rouge fault where the aquifer is offset and hydraulically separated from its equivalent unit north of the fault.

The highest water level, 154.19 ft above NGVD 29, was measured at well WF-169 in northern West Feliciana Parish (table 1). The lowest water levels of more than 90 ft below NGVD 29 were measured at wells EB-580 and EB-946 in the industrial district (table 1, fig. 5). Water levels were more than 50 ft below NGVD 29 in most of the Baton Rouge metropolitan area. A small cone of depression about 5 ft above NGVD 29 was noted at well PC-180 in eastern Pointe Coupee Parish. Another cone of depression about 95 ft below NGVD 29 was located at well EB-946. A comparison between the 1990 (Tomaszewski, 1996, p. 37) and the 2001 potentiometric-surface maps of the "1,200-foot" sand indicates water levels in the Baton Rouge metropolitan area declined about 20 ft during the 11-year period.

In spring 2001, the flow of water in the "1,200-foot" sand in the Baton Rouge area generally was down gradient from the recharge area toward pumping centers along the Mississippi River and in Baton Rouge (figs. 1, 4, 5). In East and West Feliciana Parishes, flow generally was south to southwest toward Baton Rouge. In East and West Baton Rouge and southeastern Pointe Coupee Parishes, flow was radial toward the industrial district.

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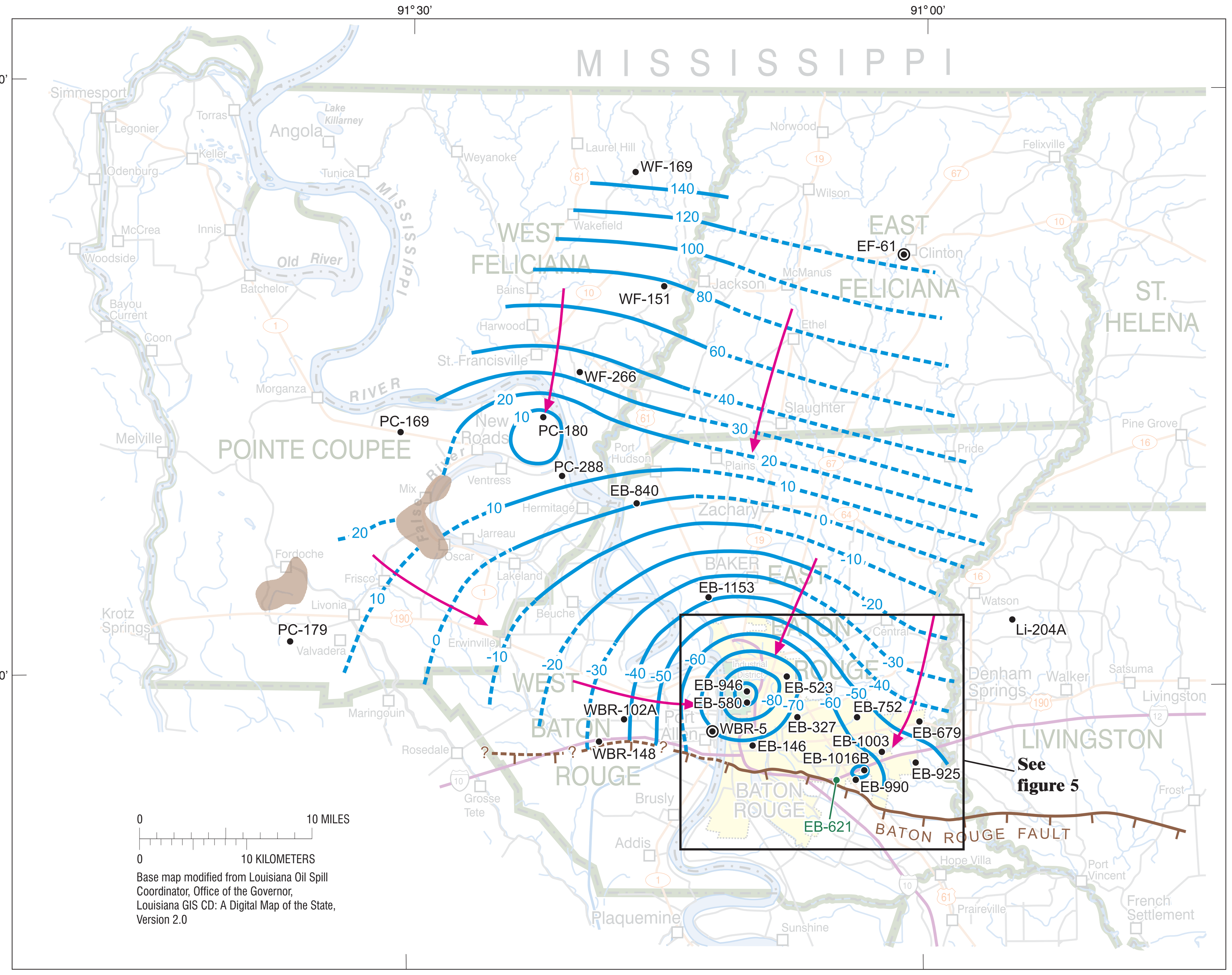

EXPLANATION

(Explanation also refers to fig. 5)

APPROXIMATE AREA WHERE THE AQUIFER IS THIN OR ABSENT (Winner and others, 1968, pl. 5)

FAULT -- Dashed and queried where probable. Hachures on downthrown side (Modified from McCulloh, 1991, pl. Ia-e)

20 POTENTIOMETRIC CONTOUR -- Shows altitude at which water level would have stood in tightly cased wells. Dashed where approximately located. Contour interval 10 and 20 feet. Vertical datum is NGVD 29

FLOW ARROW -- Shows general direction of ground-water flow

EB-327 CONTROL POINT -- Shows location and number of well used for contouring potentiometric surface (see table 1 for water-level data)

WBR-5 WELL WITH HYDROGRAPH – Shows location and number of well for which a hydrograph is shown (see fig. 3 for hydrograph)

EB-621 WATER WELL AND NUMBER

Figure 4. Potentiometric surface of the "1,200-foot" sand in the Baton Rouge area, southeastern Louisiana, spring 2001.

Table 1. Water-level data used to construct the potentiometric-surface map of the "1,200-foot" sand in the Baton Rouge area, southeastern Louisiana, spring 2001
[Well locations and numbers are shown in figures 4 and 5.]

Well number	Altitude of land surface, in feet above NGVD 29	Date measured	Water level, in feet above (+) or below (-) NGVD 29
East Baton Rouge Parish			
EB-146	52.00	4-14-01	-65.72
EB-327	55.00	4-12-01	-67.28
EB-523	59.00	4-25-01	-74.52
EB-580	65.00	4-30-01	-90.31
EB-679	40.00	4-25-01	-46.58
EB-752	49.00	5-17-01	-57.48
EB-840	95.00	4-19-01	+0.64
EB-925	40.00	4-20-01	-56.57
EB-946	59.00	5-1-01	-95.46
EB-990	44.00	4-20-01	-65.31
EB-1003	40.00	4-20-01	-56.90
EB-1016B	47.00	4-20-01	-77.16
EB-1153	72.00	4-27-01	-38.32
East Feliciana Parish			
EF-61	210.00	4-19-01	+123.89
Livingston Parish			
Li-204A	60.00	5-1-01	-17.71
Pointe Coupee Parish			
PC-169	33.00	5-3-01	+26.44
PC-179	22.00	4-20-01	+15.41
PC-180	30.00	5-3-01	+4.56
PC-288	41.00	5-3-01	+15.02
West Baton Rouge Parish			
WBR-5	27.00	4-25-01	-69.23
WBR-102A	18.00	4-25-01	-37.57
WBR-148	14.00	4-25-01	-35.24
West Feliciana Parish			
WF-151	190.00	4-11-01	+77.24
WF-169	262.00	4-12-01	+154.19
WF-266	125.00	4-6-01	+33.31

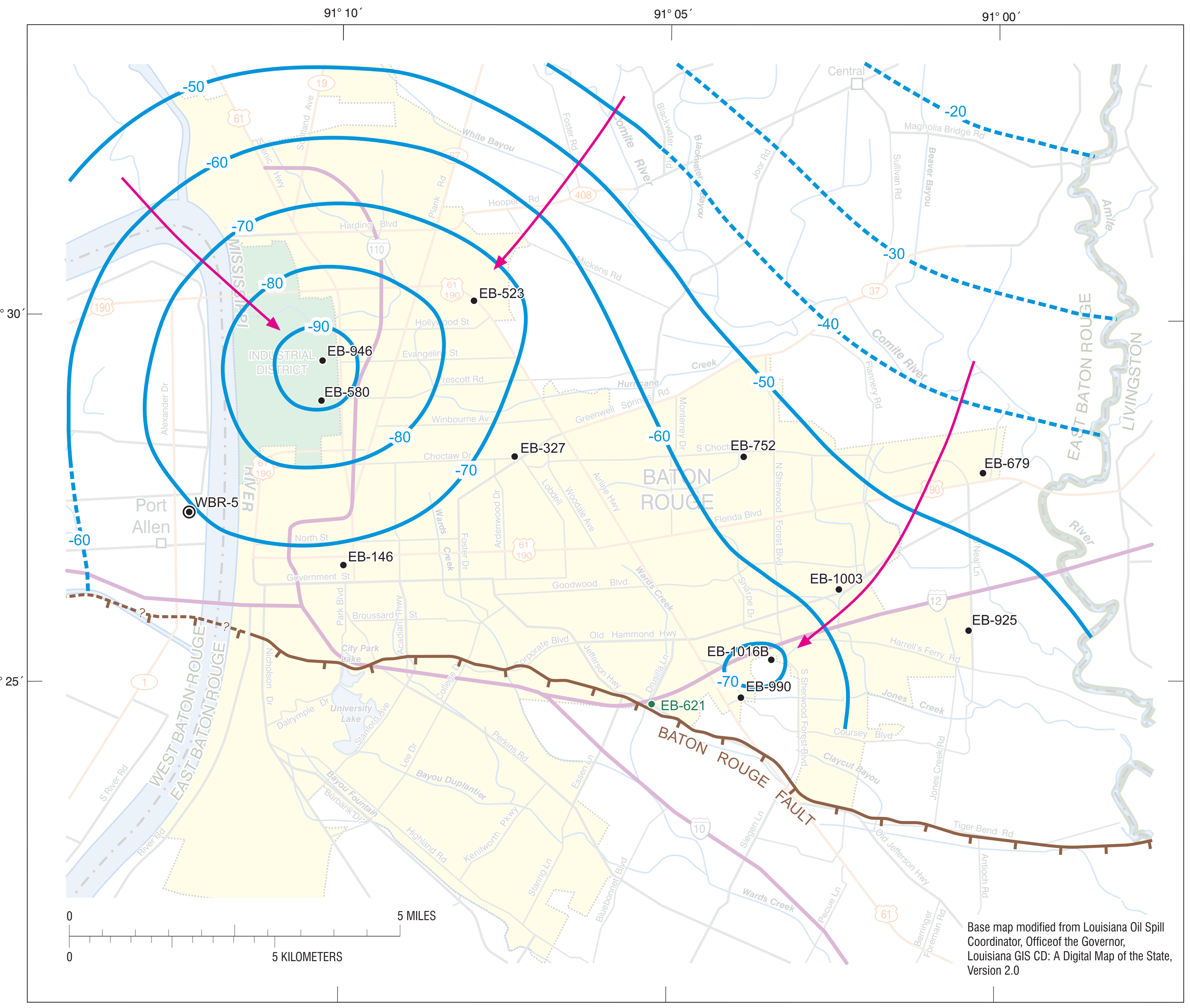

Figure 5. Potentiometric surface of the "1,200-foot" sand in parts of East and West Baton Rouge Parishes, southeastern Louisiana, spring 2001.

Louisiana Ground-Water Map No. 15:

Potentiometric Surface of the "1,200-Foot" Sand of the Baton Rouge Area, Louisiana, Spring 2001

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